

**TEACHER EVENT CHECKLIST
SPACE FOOD EXPEDITION (ASTRONAUT FOOD)**

Date Completed	PRE EVENT REQUIREMENTS
	1. Print out a copy of this entire file (color copy preferred). Please note: this document is 24 pages long.
	2. Sign Agreement to Participate on page 2 and Fax or E-mail to Distance Learning Outpost within 3 business days of confirmation.
	3. Have students take Pre-Event Quiz on page 5.
	4. Complete all pre-event activities on page 4 with the students.
	5. Teacher to E-mail a minimum of 5 student questions to our office no later than 3 business days prior to your event.
	6. Review NASA Event Guidelines on page 9 with students.
	DAY OF EVENT ACTIVITIES
	1. The students will be asked to share the results from their pre-work activities with the NASA DLO presenter.
	POST EVENT REQUIREMENTS
	1. Have students take Post-Event Quiz on page 5 for evaluation and assessment.
	2. Teacher(s) and students to fill out event feedback .
	3. Distance Learning Outpost will respond to any follow-up questions via e-mail.
	4. Students to complete extended activities on page 10 at teacher's discretion.

Teacher Agreement To Participate
NASA's Distance Learning Outpost

I have reviewed the Space Food Learning Module and agree to complete all of the required activities with my students, both prior to, and following, the video teleconferencing event.

Teacher(s) _____

School/Institution _____

Event # _____

Date of Event _____

Fax this form to the Distance Learning Outpost Office at (281) 483-3789

or

E-mail to dlo1@jsc.nasa.gov within 3 business days of confirmation.

NASA's Distance Learning Outpost
Space Food (Grades 9-12)

Instructional Goal

Upon completion of this learning module, students will be able to explain which variables are included in a person's daily dietary requirements. They will also be able to discuss space food in detail, including its purpose and how it is created, prepared and disposed.

Learning Objectives

1. Students will be able to explain the purpose of space food.
2. Students will be able to describe how space food is created, prepared, and disposed.
3. Students will be able to accurately calculate different individual's daily dietary requirements.

National Education Standards

Science Standards (NSTA)

Science as Inquiry

Abilities necessary to do science inquiry

Science in Personal and Social Perspectives

Personal Health

**STUDENTS WILL PRESENT THEIR
ACTIVITY RESULTS DURING THE VIDEO
TELECONFERENCE WITH NASA.**



Grade Level:

Grades 9-12

Estimated Time Requirements:

1. Preparation Time
 - a. Time necessary to download & print the lesson from the computer
 - b. Time necessary to become familiar with the lesson
2. Execution Time by Activity
 - a. Activity Set #1 30 minutes
 - b. Activity Set #2
 - i. Activity A 3 weeks
 - ii. Activity B 45 minutes
 - c. Activity Set #3 25 minutes
 - d. Video Teleconference 50 minutes

Texas Essential Knowledge and Skills (TEKS)
9-12

Science

2.B

12.E

INSTRUCTIONAL STRATEGY

Overview

Everyone knows that people on Earth need food in order to stay alive. If we are in space, does that requirement change? The answer is no. Astronauts need food in order to live in space just as when they are on Earth. The trick is that they cannot run to the grocery store before launch because there are several requirements the food must meet to make it aboard the Space Shuttle.

Pre-Event Classroom Component

Activity Set #1

1. Students take [Pre-Event Quiz](#) on page 5 to test their knowledge prior to these lessons about space food. Students keep these quizzes on file to compare to their [Post-Event Quiz](#) for evaluation and assessment.
2. Students should become familiar with the [terminology](#) on page 8 that will be used in the activities and during the event with NASA. It is up to the teacher's discretion on how and when to introduce the terms.

Activity Set #2

Please complete the two activities below with your class.

1. Activity A - [Irradiation](#) at: http://www.nasaexplores.com/show2_912a.php?id=02-042&gl=912

In this activity, students will explore whether or not irradiation makes a difference in appearance or taste. **Students will be asked to share their data tables during the video teleconference.**

2. Activity B – [Bottles or Cans?](#) at: http://www.nasaexplores.com/show2_912a.php?id=02-042&gl=912

In this activity, students will use a variety of experiments to determine whether plastic or aluminum is a better container for carbonated soft drinks. **Students will be asked to share which package received the most votes.**

Activity Set #3

1. Student Questions
 - Develop at least 5 questions from the class on space food
 - These questions should go beyond the basic information within the program
 - E-mail your questions at least 3 business days prior to your event with NASA
 - E-mail address is: DLO1@jsc.NASA.gov
2. Prepare students for their participation in a live, interactive video teleconference with NASA's Distance Learning Outpost using the [guide](#) on page 9.

Pre/Post Quiz
Space Food Expedition

1. What is the purpose of space food?

2. What are the differences between space food and Earth food?

3. Name and describe as many ways as you can think of to create space food.

4. While in space, how do astronauts prepare their food?

5. While in space, how do astronauts dispose of the food's packaging?

6. What factors are included in a person's daily dietary requirements?

Pre/Post Quiz Space Food Expedition

TEACHER ANSWER KEY – Please don't share with the students. Answers should be similar to:

1. What is the purpose of space food and what must be considered when making it?

Since an astronaut cannot just run to the store or vending machine when they are hungry, NASA must send food up with them. They need food especially made for travel and consumption in space. Some of the things they must consider are:

- Shelf life- because they need food that is safe and lasts a long time
- Taste- because being in space affects your sense of taste and appetite
- Nutrition- because astronauts need to eat healthy foods to get energy
- Microgravity- because without much gravity, food can float everywhere and make a mess. That is why astronauts drink from straws and don't have foods that make a lot of crumbs.
- Weight- because a shuttle can only hold a certain amount of weight
- Waste- because they only have so much room for garbage, they use pouches that are flat and lightweight.

2. What are the differences between space food and Earth food?

NASA tries to make the foods that astronauts have in their homes on Earth. They just modify them so that they can go to space. In some cases, the food they take is the same as we buy at the store only packaged in lightweight, vacuum-sealed bags with Velcro. Other foods are pre-cooked and packaged in special pouches. Some foods and all of their drinks are dehydrated.

One major difference is that all of the foods are ready to eat. All the astronauts have to do is heat them up or just add water.

3. Name and describe as many ways as you can think of to create space food.

- Natural form- ready to eat foods packaged in clear, flexible pouches that are cut open with scissors, and require no further preparation for consumption in flight. Examples include candy, nuts, granola bars and cookies.
- Thermostabilized-foods cooked in their containers (retort pouches, cans, or cups) to destroy harmful microorganisms and enzymes.
- Rehydratable- food that has the water removed from it on Earth. While in space, the astronauts add water so that the food returns to its original form.
- Irradiated- process where food is exposed to radiation to kill harmful bacteria and other microscopic creatures that cause food to spoil and illness in people. Irradiation uses waves of radiation much like an x-ray or a microwave oven and is done while on Earth.

4. While in space, how do astronauts prepare their food?

Astronauts have a specially made tray that is equipped with Velcro patches to keep the food pouches in place and magnets to keep the silverware in place. The silverware includes a fork, spoon and a pair of scissors. For natural form foods, the astronauts simply cut open the bag and eat it. Astronauts also cut open the retort pouches holding the thermostabilized and irradiated foods in them and warm them in an electric oven. Rehydratable food and beverages are packaged in pouches that have a special septum built in to them. The astronauts use the galley, which has a special machine that plugs into the septum of the rehydratable packages, to pump water into these bags. They drink the beverages through straws.

5. *While in space, how do astronauts dispose of the food's packaging?*

The food packaging used in space comes back to Earth with the astronauts. The astronauts designate a special area where they keep all of the used packages and stack them very carefully so they have enough space for everything. They have a bag for wet trash and one for dry trash. That is why the flexible pouches are so important.

6. *What factors are included in a person's daily dietary requirements?*

When considering one's daily dietary requirement it is important to think of the types of food (dairy, fruits and vegetables, meats, etc.) and the number of calories consumed. A person should govern their proportions of different types of food they eat using the Daily Food Guide (see Activity A)

To figure out how many calories an individual needs to operate, one considers primarily the activity level and uses the basal metabolic rate (BMR) equation. The BMR result varies from person to person because it depends greatly on the individual's gender, size, and age. The goal is to eat as many calories as is required to perform the individual's daily activities.

Space Food Terminology

The following is a list of words and definitions that your students need to be familiar with because the words are used throughout the activities and video teleconference. They will be asked to explain the meaning of these terms **in their own words** during the video teleconference.

1. Nutrients needed to promote growth and health
2. Daily Dietary Requirements the average daily dietary intake level that is sufficient to meet the person's nutrient requirement
3. Basal Metabolic Rate (BMR) minimal caloric requirement needed to sustain life in a resting individual
4. Space Food food that is eaten in space
5. Sensory Evaluation systematic rating of how a food looks, smells, feels, and tastes performed by NASA scientists and astronauts
6. Rehydration process to restore fluid to an item
7. Irradiation process where the food is exposed to radiation
8. Thermostabilization process where foods are heated to destroy harmful microorganisms and enzymes
9. Natural unchanged

Background Articles to Help You Become Familiar with Space Food

A Matter of Taste http://nasaexplores.com/search_nav_5_8.php?id=03-038&gl=58

No Pizza in Space http://www.nasaexplores.com/show2_article.php?id=01-022

NASA Event Guidelines

Review the following points with your students prior to the video teleconference event:

1. A video teleconference is a two-way event. Students and NASA presenters can see and hear one another.
2. Students are representing their school; they should be on their best behavior.
3. Students should be prepared to give brief presentations, ask questions and respond to the NASA presenters.
4. A Teacher(s) or other site facilitator should moderate students' questions and answers.
5. Students should speak into the microphone in a loud, clear voice.

**Get Ready, Be Ready, and have fun with your
Distance Learning Event with NASA!**

Post Event Teacher – Student Evaluation

1. **We need your help and support!** Choose the appropriate Form below. It usually takes teachers and students **less than 10 minutes** to complete. We welcome any input that you have at the following sites:
 1. Teacher Feedback Form:
https://ehb2.gsfc.nasa.gov/edcats/centers/distance_learning.html
 2. Student K-4 Feedback Form:
[TBD](#)
 3. Student 5-8 Feedback Form:
[TBD](#)
 4. Student 9-12 Feedback Form:
[TBD](#)
 5. Technical Contact Feedback Form:
https://ehb2.gsfc.nasa.gov/edcats/centers/jsc_dlo_tech_contact.html
 6. Parent/Chaperone Feedback Form:
https://ehb2.gsfc.nasa.gov/edcats/centers/distance_learning_parent.html
2. Students and Teachers are **welcome to e-mail the Distance Learning Outpost** with any follow-up questions from the event at: DLO1@jsc.NASA.gov
3. Please send us any photos, video, school web page link, newspapers articles, etc. of your event. We will be glad to post them on our web page!

Extended Activities for Space Food

1. Perform further research on the Internet at
<http://spacelink.nasa.gov/Instructional.Materials/NASA.Educational.Products/Space.Food.and.Nutrition/Space.Food.and.Nutrition.pdf>
or
<http://www.nasa.gov/>